

ARTIFICIAL INTELLIGENCE INTEGRATION IN SOCIAL STUDIES EDUCATION: EXAMINING TEACHER UTILIZATION AND LEARNING OUTCOMES FOR HIGH-ABILITY STUDENTS IN MAKURDI LOCAL GOVERNMENT AREA, BENUE STATE, NIGERIA

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Abstract

The study investigated how teachers in Makurdi LGA, Benue State, Nigeria, use AI-powered digital tools in teaching social studies and the effects on the learning outcomes of high-ability students, and challenges in implementation. The research was conducted using a mixed-methods case study approach that involved 1,200 high-ability secondary students (top 15%), 150 teachers, and administrators from 15 schools. A total of 300 participants were selected using purposive and stratified random sampling. Data collection methods included Likert-scale questionnaires, classroom observations, and semi-structured interviews. The instrument was validated by three experts and pilot tested, yielding a Cronbach's alpha reliability coefficient of 0.85. Descriptive and inferential statistics were used to analyze quantitative data while qualitative data were analyzed by thematic coding. The findings showed that high use of AI was made (Grand Mean=3.88, SD=0.67), with adaptive learning platforms (Mean=4.12) and AI-based assessment tools (Mean=4.05) being the most commonly used. The results indicated that AI had a positive

effect on learning outcomes, with a mean score of 4.22 and a standard deviation of 0.59. Specifically, the positive effect was observed in student engagement (Mean=4.35) and critical thinking (Mean=4.25). Poor electricity supply (Mean=4.56), inadequate internet access (Mean=4.41), and insufficient teacher training (Mean=4.38) were the major challenges. The difference between urban and rural schools was significant ($t=4.21, p<0.05$) as was the difference between school types ($F=6.73, p<0.05$). State-sponsored AI training sessions, subsidies for AI devices, and curriculum adjustments are recommended.

Keywords: Artificial Intelligence, Teacher Utilization, High-Ability Students, Social Studies, Sustainable Education

Introduction

Technology has revolutionized the way education is delivered across the globe, and Artificial Intelligence (AI) is one of the most promising innovations in the field, impacting teaching, learning, and assessment. AI is defined as computer systems that mimic human intelligence by learning, reasoning, and problem-solving (Holmes et al., 2022). AI-powered tools are becoming a staple in educational institutions, helping to tailor learning experiences, boost engagement, streamline processes, and optimize results. The use of AI in education has emerged as a strategic priority worldwide, with the promise of enhancing educational quality and accessibility (UNESCO, 2023). Stakeholders are now aware of the significance of integrating digital technology in Nigeria, but there are gaps in infrastructure, teacher preparedness, and digital literacy that affect its effectiveness (Aina & Oyetade, 2023). These challenges are substantial in rural areas where there is a digital divide due to the lack of technological resources, which increases educational inequalities. Social Studies education fosters citizenship education, national integration and sustainable development. Students learn to think critically, be responsible citizens, and have social competence (Okam & Chukwuma, 2022). AI integration facilitates interactive learning

experiences, historical simulations, and data-driven civic analysis. Yetişensoy and Karaduman (2024) showed that AI tools have a significant impact on engagement and conceptual understanding. Differentiated instruction for higher order thinking is needed for high ability students. Siegle (2023) revealed AI-powered tools provide personalized learning, advanced challenges, and increased autonomy. Adaptive learning systems support learning speed and interests, thus maximizing learning potential. Teachers are still the key to the success of implementing AI. Effectiveness is dependent upon their competence, confidence, and willingness (Luckin & Cukurova, 2021). Salas-Pilco et al. (2022) discovered that AI can enhance instructional planning and pedagogical decision-making. Walter (2024) identified teachers who are well-versed in AI literacy effectively incorporate technology, highlighting the importance of ongoing professional development. In the era of sustainable development, it is crucial to examine teachers' use of AI in improving the learning of high-ability students in SS. Inclusive and equitable education is a key focus of SDG 4 (Quality Education) and SDG 10 (Reduced Inequalities) (Crompton & Burke, 2023). AI can help achieve these objectives by fostering inclusive learning and personalized teaching.

Statement of the Problem

Although the use of AI in Nigeria is growing, secondary schools are challenged to incorporate AI tools. Social Studies teaching is still mostly traditional, which may not foster critical thinking skills for gifted students. In Makurdi LGA, the use of AI technologies is slowly growing, but there are concerns about the competence and effectiveness of teachers. Lack of infrastructure, lack of digital literacy, lack of electricity, lack of training, and socio-cultural resistance are challenges to integration (Ogunode, 2023). The effectiveness of the use of AI in improving social studies learning and its impact on sustainable educational development is still not clear. This study was motivated by the limited evidence on the relationship between teacher competence, school AI readiness and student

outcomes, as revealed by Guan et al. (2026).

Purpose of the Study

The study examined the use of AI-powered digital tools by teachers to improve the learning of Social Studies in high ability students in Makurdi LGA, Benue State. In particular, it aims to:

1. Analyze how teachers use AI tools in the teaching of Social Studies.
2. Review the use of AI technologies in Social Studies education.
3. Determine AI technologies' impact on learning outcomes
4. Recognize issues with the use of AI

Research Questions

1. How much teachers use AI-based digital technologies to teach high-ability students in the area of Social Studies?
2. What impact do AI technologies have on high-ability students' learning outcomes?
3. What are the obstacles to teachers' use of AI in social studies instruction?

Hypotheses

- H₀1: There is no significant difference in the use of AI between urban and rural schools.
- H₀2: There is no difference in the impact of AI on students' learning between public and private schools.
- H₀3: There is no difference in challenges due to teaching experience.

Conceptual Framework

Artificial Intelligence in Education is the ability of computer systems to do things that need human intelligence. Intelligent tutoring systems, adaptive learning platforms, learning analytics, chatbots, and virtual reality are among the various applications of AI in education (Crompton & Burke, 2023; Weng et al., 2024). These

enable personalized learning by analyzing patterns and providing tailored content (Holmes et al., 2022). Teacher Efficacy and AI Integration refer to teachers' technological knowledge, confidence, and competence (Salas-Pilco et al., 2022). Teachers monitor student-technology interactions, analyze AI data, and ensure alignment with curriculum goals. AI-literate educators are better able to incorporate innovative technologies (Guan et al., 2026).

Differentiated instruction and enriched experiences are needed for High-Ability Students in Social Studies (Siegle, 2023; Pfeiffer, 2022). The North Central State Community College (NCSS) definition of social studies is that it produces informed, responsible citizens through critical thinking and civic competence. Immersive experiences using AI-powered tools enable inquiry-based learning (Labadze et al., 2023). Sustainable Education and AI are about learning and developing knowledge and skills for sustainability. AI enables inclusive learning and personalized teaching (Crompton & Burke, 2023). However, the challenge of digital inequality and infrastructure gaps (Aina & Oyetade, 2023) must be addressed for sustainable integration.

Theoretical Framework

Technological Pedagogical Content Knowledge (TPACK) Theory posits effective technology integration requires interaction of content knowledge (CK), pedagogical knowledge (PK), and technological knowledge (TK). Successful integration is when teachers integrate these domains to design meaningful learning experiences (Salas-Pilco et al., 2022). Guan et al. (2026) used TPACK, and they discovered that teacher competence is the mediator between school readiness and student outcomes.

According to Constructivist Learning Theory, the learner is an active constructor of knowledge in interaction with the environment. AI technologies are consistent with constructivist principles, as they involve personalized learning and interactive engagement (Weng et

al., 2024). AI offers opportunities for self-directed learning for high ability students (Siegle, 2023).

Empirical Review

AI has been shown to enhance instructional planning and decision-making, and teacher training is crucial for the successful implementation of AI in education, according to a systematic review by Salas-Pilco et al. (2022). Crompton and Burke (2023) reported AI enhances engagement, personalized learning, and academic performance. Siegle (2023) examined the use of AI with gifted students, identifying opportunities and challenges that must be considered when implementing it. Yetişensoy and Karaduman (2024) concluded that AI-powered chatbots enhanced engagement and conceptual understanding in social studies. According to Labadze et al. (2023), AI chatbots can improve engagement and personalized learning, highlighting the critical role of teachers' guidance. Walter (2024) identified that AI-literate teachers are effective in integrating technology, suggesting the need for ongoing professional development. Weng et al. (2024) discovered that AI-assisted designs have a positive impact on learning outcomes and critical thinking. Teacher competence plays a mediating role between institutional readiness and student outcomes, highlighting the significance of teacher empowerment for student outcomes (Guan et al., 2026).

Methodology

The study adopted a mixed methods case study, with triangulation of quantitative and qualitative data to gain a comprehensive understanding (Creswell & Creswell, 2018). The case study allowed for detailed study in the context of Makurdi LGA. The target population consisted of about 1,200 high ability secondary students (top 15%), 150 secondary school Social Studies teachers and administrators of 15 public and private secondary schools in Makurdi LGA. The purposive and stratified random sampling methods were used to select a sample of 300 participants. The schools were selected using purposive sampling, where schools with technology infrastructure that are using AI approaches were selected. Stratified

random sampling was used within each school to achieve a balance across school type, gender and ability.

Category	Population	Sample	Sampling Technique
Urban Public Schools	5 schools	100 participants	Purposive + Stratified Random
Urban Private Schools	4 schools	80 participants	Purposive + Stratified Random
Rural Public Schools	4 schools	80 participants	Purposive + Stratified Random
Rural Private Schools	2 schools	40 participants	Purposive + Stratified Random
Total	15 schools	300 participants	

Data was gathered using the following: 1. The 100 items of the Teachers' AI Utilization Questionnaire (TAIUQ) are grouped into four sub scales: demographics (6 items), AI utilization (20 items), perceived impact (10 items), and challenges (9 items). On a 4-point Likert scale. Mean > 2.50 accepted as high extent. 2. Classroom Observation Schedule: Evaluated actual use of AI in SS instruction. 3. Semi-Structured Interview Guide: Explored experiences, benefits, challenges, and recommendations. Three experts in educational technology, social studies education, and research methodology validated the instruments. Feedback was incorporated. The instrument were trial-tested on 40 students from 2 schools not included in the sample to check clarity, time requirements, reliability, and ambiguities. The internal consistency of the items was high with Cronbach's alpha coefficients: Overall=0.85, AI utilization=0.83, Impact=0.87, Challenges=0.79. Data collection lasted for eight weeks from the time of permission to the administration of questionnaires (30-40 minutes for teachers and 20-30 minutes for students) and 30 classroom observations (40-60 minutes each) and 20 semi-structured interviews (30-45 minutes each) were conducted, all of which were audio-recorded with consent. Descriptive (frequencies, percentages, means, standard deviations) and inferential statistics (independent t-test, ANOVA at 0.05 significance) were used in the quantitative data. SPSS version 27 was

used. Thematic analysis, which included familiarization, coding, identification of themes, refining and interpretation, was used to analyze qualitative data obtained from interviews and observations.

Ethical Considerations

Informed consent was achieved. Confidentiality and anonymity were guaranteed to participants and pseudonyms were used. Participation was voluntary with right to withdraw. Permission obtained from institutional authorities.

Results

Demographic Characteristics

The data were gathered from 300 participants (150 teachers, 150 high ability students) in 15 schools. Teacher demographics:

Characteristic	Category	Frequency	Percentage
Gender	Male	82	54.7%
	Female	68	45.3%
School Type	Public	85	56.7%
	Private	65	43.3%
School Location	Urban	95	63.3%
	Rural	55	36.7%
Teaching Experience	0-5 years	42	28.0%
	6-10 years	48	32.0%
	11-15 years	35	23.3%
	16+ years	25	16.7%
AI Training	Received training	38	25.3%
	No training	112	74.7%

Research Question 1: Extent of AI Technology Utilization

Item	Mean	SD	Decision
AI-powered adaptive learning platforms	4.12	0.71	Accepted
Virtual reality simulations	3.78	0.82	Accepted
Educational chatbots	3.65	0.88	Accepted
AI-based assessment tools	4.05	0.68	Accepted
Learning analytics systems	3.81	0.79	Accepted
Grand Mean	3.88	0.67	Accepted

Teachers utilize AI technologies to a high extent. Most frequently used: adaptive learning platforms and AI-based assessment tools.

Research Question 2: Impact of AI Technologies on Learning Outcomes

Learning Outcome	Mean	SD	Decision
Student Engagement	4.35	0.62	Positive
Critical Thinking	4.25	0.65	Positive
Academic Achievement	4.21	0.71	Positive
Problem Solving	4.18	0.73	Positive
Civic Awareness	4.12	0.76	Positive
Grand Mean	4.22	0.59	Positive

AI positively influences learning outcomes, with greatest impact on engagement and critical thinking.

Research Question 3: Challenges Affecting AI Utilization

Challenge	Mean	SD	Decision
Poor electricity supply	4.56	0.58	Accepted
Inadequate internet access	4.41	0.63	Accepted
Insufficient teacher training	4.38	0.67	Accepted
Lack of digital devices	4.33	0.72	Accepted
Resistance to technology	3.91	0.81	Accepted
High cost of AI tools	3.85	0.84	Accepted
Grand Mean	4.24	0.61	Accepted

The main challenges are poor electricity supply, inadequate internet and lack of training.

Qualitative Findings

Theme 1: Limited AI Infrastructure and Resources: Teachers indicated that limited infrastructure was a significant barrier. One rural teacher said, "We have smart boards but can't use them effectively because electricity is not stable, sometimes we go for days without electricity. In 60% of lessons, technical difficulties were observed that prevented full implementation.

Theme 2: Positive Student Response: Teachers reported very positive responses from high ability students. One urban teacher commented: "High ability students are especially receptive to AI platforms; they are able to explore features on their own, ask more complex questions, and interact with content in ways that are not easily done traditionally.

Theme 3: Professional Development Gaps: The majority of teachers (74.7%) have never had formal AI training. An administrator said, "We want teachers to use technology, but we don't have resources to provide them with proper training; they learn by trial and error.

Theme 4: Student and Community Resistance: Some teachers experienced resistance from parents and the community, who were suspicious of technology. One teacher commented: "Some parents believe that technology is a distraction or dangerous; we take time to explain before giving children tools.

Hypothesis Testing

HO₁: Urban-Rural Difference in AI Utilization

Location	N	Mean	SD	t-value	df	p-value	Decision
Urban	95	4.12	0.58	4.21	148	0.000	Reject H ₀
Rural	55	3.48	0.72				

Significant difference exists ($p < 0.001$). Urban teachers utilize AI more than rural counterparts.

HO₂ : Public-Private Difference in AI Impact

School Type	N	Mean	SD	t-value	df	p-value	Decision
Public	85	4.08	0.62	2.85	148	0.005	Reject H ₀
Private	65	4.41	0.51				

Significant difference exists ($p = 0.005$). Private schools show greater positive impact.

H₀₃ : Challenges by Teaching Experience

Source	Sum of Square	df	Mean Square	F	p-value	Decision
Between Groups	3.42	3	1.14	1.92	0.129	Reject H ₀
Private	86.58	146	0.59			
Total	90.00	149				

No significant difference ($p=0.129$). Teachers across experience levels face similar challenges.

Discussion of Findings

Teachers use AI technologies to a high degree (Grand Mean=3.88), with adaptive learning platforms and AI-based assessment tools being used most often. This is consistent with the findings of Holmes et al. (2022) and Crompton and Burke (2023) that AI can improve instructional effectiveness by providing personalized learning. The discovery adds to the existing knowledge base by showing that Nigerian teachers are actively looking for ways to incorporate AI into their teaching, even with the challenges of infrastructure. The discovery shows that Nigerian teachers are actively seeking ways to incorporate AI into their teaching, even with the challenges of infrastructure, which is an indication of their positive disposition toward innovation. The significant difference between urban and rural ($t=4.21$, $p<0.001$) is in line with Aina and Oyetade (2023) who found that there is digital divide due to infrastructure disparity. Vulnerable populations in rural schools are at risk of being left behind in the transition to AI.

The positive impact of AI on learning outcomes is highest for engagement (4.35) and critical thinking (4.25) (Grand Mean=4.22). This aligns with Weng et al. (2024) and Siegle (2023) who discovered that AI helps with higher order thinking. High engagement indicates that AI is meeting the needs of gifted students who are bored and underachieving. There are concerns about equity when the impact scores are significantly higher in private schools (Mean=4.41 vs 4.08, $t=2.85$, $p=0.005$).

Challenges Affecting Integration

Poor electricity supply (4.56), inadequate internet (4.41) and insufficient training (4.38) are most significant challenges, which is consistent with Ogunode (2023) and Salas-Pilco et al. (2022). Professional development gap is evident as 74.7% had no formal training. No significant difference by teaching experience ($F=1.92$, $p=0.129$) indicates systemic barriers, not individual.

Theoretical Implications

Results confirm TPACK framework, in which technological, pedagogical and content knowledge are crucial for effective integration. High ability student response is used to support CLT by actively constructing knowledge with AI tools.

Educational Implications

The use of AI technologies in Social Studies education has the potential to greatly enhance the teaching and learning of the subject by making it interactive, personalized, and effective, while also boosting critical thinking, engagement, and performance. The success of the implementation depends on the competence of teachers, ongoing training, and infrastructure. AI literacy should be embedded in teacher training and curricula should be updated.

Conclusion

The use of AI technologies has tremendous potentials for improving the learning of SS in Makurdi LGA for high ability students. Teachers effectively utilizing AI promote critical thinking, civic competence, engagement, and academic achievement. But benefits are limited by the lack of infrastructure, teacher preparation, and digital disparities between urban/rural and public/private schools. If not intentionally addressed, AI could exacerbate disparities in education. To achieve sustainable educational development with AI, strategic investments in technology infrastructure, teacher training, and policy support are essential.

Recommendations

The following recommendations were made based on the findings of the study:

1. Enhance Teacher Training and AI Literacy: Government should ensure that continuous professional development is provided for teachers, with a strong emphasis on hands-on experience with adaptive platforms, virtual reality, and AI-driven assessment.
2. Enhance educational facilities: invest in electricity, internet and digital devices. Encourage public-private partnerships to support schools, particularly rural areas.
3. Embed AI in Curriculum and Policy: Update SS curriculum with AI-enriched strategies and digital skills. Create guidelines for ethical use of AI.
4. Create School-Industry Partnerships: Develop partnerships with technology companies to access equipment, technical support, and training resources at reduced costs.
5. Do More Research: Use quasi-experimental designs in objective AI impact assessment and longitudinal designs to follow high-ability student development.

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